The Future of Airborne Reconnaissance

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EXECUTIVE SUMMARY

Title: The Future of Airborne Reconnaissance

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Thesis: Airborne reconnaissance has progressed rapidly, hand in hand with technology; however, current investments and plans fall short of fulfilling the future role of aerial reconnaissance in supporting the United States' national security and the intelligence requirements of the warfighter. Historical deficiencies and current shortfalls, including an inadequate force structure (lack of commonality between service platforms, sensors, and ground stations), poor dissemination architectures, and a disjointed tasking process require changes in the four pillars that embody airborne reconnaissance: equipment, doctrine, organization, and training.

Discussion: This paper briefly explores the history of airborne reconnaissance and how it migrated to an inadequate mix of stovepipe systems; reviews the shortfalls and deficiencies associated with reconnaissance operations in DESERT SHIELD/STORM; discusses current reconnaissance system inadequacies; argues the impact and/or benefits of the Defense Airborne Reconnaissance Office (DARO) in alleviating these shortcomings; and finally, discusses the disjointed tasking process within the joint force organization.

Focus on a single major threat during the Cold War drove airborne reconnaissance assets to a specialized, redundant set of collection platforms, narrowly focused on a two-sided scenario. However, several other factors contributed to this paradigm, including funding priorities, inter-Service mistrust and lack of confidence, secrecy and compartmentalization, and the introduction of space-based systems.

During DESERT STORM, over 80% of all airborne reconnaissance assets were employed to support SIGINT and IMINT requirements. These assets were only able to satisfy a fraction of the overall intelligence requirement. The experiences from DESERT STORM indicate that a number of specific improvements to our airborne reconnaissance capabilities are needed, including continuous broad area coverage, high resolution IMINT and SIGINT to support precision strikes, and assured delivery to the warfighter. In addition, from a systems perspective, the current reconnaissance community has an inadequate force structure with too many unique airframes, sensors, and ground stations.

On 6 Nov 1991, the Deputy Secretary of Defense created the DARO and this new agency developed an integrated airborne reconnaissance *Objective Architecture.* Although the *Objective Architecture* addresses most of the shortfalls and deficiencies, it falls short of the mark for several reasons. First, the individual services have not endorsed the architecture. Second, all reconnaissance assets do not fall under the DAROs purview, limiting their effectiveness. And finally, the current reconnaissance

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force structure is not being upgraded and is slowly being raped of funding to support the UAV initiative, creating a "recce capabilities void."

Historically, airborne reconnaissance assets have conducted operations "ad hoc" and through Service channels. Modern warfare requires U.S. forces to fight as a joint team whether operating unilaterally or as part of an international coalition, requiring airborne reconnaissance assets to be fully integrated and synchronized into a Joint Task Force to achieve strategic, operational, and tactical goals.

Conclusion/Recommendations: The ability to prevail in future conflicts necessitates providing the warfighter with responsive and sustained intelligence data from anywhere within enemy territory, day or night, and regardless of weather. This capability can only be accomplished by changing the pillars of reconnaissance: equipment, organization, doctrine, and training.

With respect to equipment, the solutions require the Services to formally sign up to the DARO's *Objective Architecture* and investment strategies. Ail current and future acquisition of reconnaissance assets must fall under the DARO after the service requirements have been articulated.

Changes to organization and doctrine are interrelated. Within a Unified command and Joint Task Force organization, there needs to be a functioning Joint Intelligence Center and Joint Reconnaissance Center consisting of experienced military members with a thorough knowledge of reconnaissance systems' capabilities (i.e., platforms, sensors, datalinks, and ground stations). These staffs should be assigned to the J2 and J3 as outlined in Joint Doctrine (e.g., Joint Pub 3-55 and 3-56.1). Additionally, a joint reconnaissance cell consisting of operations and intelligence personnel should be created to augment the Joint Force Air Component Commander's Joint Air Operating Center and would be the central manager for all airborne reconnaissance operations.

Training links changes in equipment, doctrine, and organization by evaluating each in realistic as possible conditions exposing flaws, shortfalls, and deficiencies, while highlighting what works. Furthermore, an important by-product of training is the attainment of experience and confidence, which enhances productivity and efficiency. For these reasons, realistic training is a must at all levels of service. Every effort must be made to include intelligence staffs, platforms, and operators in training exercises and not just simulate the reconnaissance asset and the intelligence cycle as is presently done today.

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CHAPTER 1

INTRODUCTION

> U.S. intelligence capabilities are critical instruments of our national power and remain an integral part of our national security strategy. Only a strong intelligence effort can provide adequate warning of threats to U.S. national security and identify opportunities for advancing our interests.
>
> The White House National Security
> Strategy of Engagement and Enlargement
> February 1995

Intelligence means many things to many people. To some it means spies, while to others it conjures visions of clandestine air operations or "hi-tech" satellites. To yet others it means analysis, deducing an adversary's intentions, and explaining all foreign activities in the political and military realms. Although all these images relate in some way to United States intelligence, the scope of this paper will focus on intelligence with respect to airborne reconnaissance. Airborne reconnaissance has progressed rapidly, hand in hand with technology; however, current investments and plans fall short of fulfilling the future role of aerial reconnaissance in supporting the United States' national security and the intelligence requirements of the warfighter. Historical deficiencies and current shortfalls, including an inadequate force structure (lack of commonality between service platforms, sensors, and ground stations), poor dissemination architectures, and a disjointed tasking process require changes in the four pillars that embody airborne reconnaissance: equipment, doctrine, organization, and training.

This paper will focus on airborne reconnaissance by briefly reviewing the historical trends and shortfalls of aerial reconnaissance. Second, it will review the problems and lessons learned from DESERT SHIELD/STORM and in the post war period, including the impact and/or benefit of the Secretary of Defense's Defense Airborne Reconnaissance Office (DARO) in alleviating these problems. And finally, it

will assess the current joint reconnaissance structure and tasking process, recommend solutions and discuss the benefits/impact to the warfighter.

Overview

Intelligence was previously recognized as a vital tool of diplomacy and conflict by Sun Tzu, the great Chinese military theorist of the 4th century BC; who stressed the importance and necessity of viable intelligence. In his book *The Art of War,* Sun Tzu outlined the requirement to invest in spies and furnished detailed instructions for organizing an espionage system.[1] Throughout history, rulers and military chiefs have used different tools to gather intelligence. Early ground conflicts utilized cavalry units to conduct this function; however, small groups of scouts or large military formations were also assigned the intelligence collection mission. Not infrequently, commanders performed their own reconnaissance and analysis.

The divorce of reconnaissance from the cavalry and like ground units took place with the advent of flight. Ever since man first carried himself aloft in balloons, he regarded the air above him as the perfect medium from which to observe his enemies; however, there were skeptics among military/civilian leaders. During the American Civil War, demonstrations by balloonist Thaddeus C.L. Lowe convinced military and civilian leadership that there was great value in airborne reconnaissance.[2] The advent of powered, heavier-than-air flight gave military leadership even greater flexibility in reconnaissance. In fact, the world's first military aircraft--the 1908 Wright Flyer--was acquired just to fulfill the reconnaissance requirement. From World War I spotting and observation missions over the trench-scared battlefields by primitive biplanes to the worldwide Cold War missions of the U-2 and SR-71, airborne reconnaissance has become an indispensable tool to the intelligence community and the National Command Authorities.

The capabilities and practices of observing the earth from the air has gone far

beyond Thaddeus Lowe's expectations. The technology of airborne reconnaissance is no longer as simple as peering over the edge of a balloon. The human eye--which gave way first to crude cameras--has been replaced by highly technical imaging systems that can acquire data across the electromagnetic spectrum. Additionally, the analysis and dissemination of data has become more involved and complicated. Interpretation of images with the aide of optical stereo scopes and subsequent dissemination by official couriers have given way to computer algorithms, data transfer rates, and complex communication links.

As the term implies, airborne reconnaissance employs airborne assets as collection platforms. Imagery Intelligence (IMINT), Signals Intelligence (SIGINT), Radar Intelligence (RADINT), and Measurement and Signature Intelligence (MASINT) are some of the intelligence collection disciplines performed by airborne systems. It is critical to understand that an airborne reconnaissance asset is a weapon system consisting of four coequal parts: the platform, sensor, datalink and/or communications system, and ground stations. Current airborne assets available consist of platforms governed by Sensitive Reconnaissance Operations (SRO) procedures, such as the U-2, RC- 135, and the EP-3, and traditional theater/fleet tactical reconnaissance systems like the F-14 equipped with the Tactical Airborne Reconnaissance Pod System (TARPS), ES-3, RC- 12 Guardrail System, and the Pioneer Unmanned Airborne Vehicle (UAV).

CHAPTER 2

AIRBORNE RECONNAISSANCE
A HISTORICAL PERSPECTIVE

> An outstanding facet of the Korean War was the number of old lessons that had to be relearned. . .It appears that these lessons either were forgotten or never documented--or if documented, were never disseminated.
>
> General O.P. Weyland
> Far East Air Forces Commander

The abrupt collapse of the former Soviet Union and the resultant end of the Cold War era fundamentally changed the United States' intelligence requirements. The elimination of a single major threat, coupled with the problems associated with weapons proliferation, ethnic unrest, and numerous volatile regional situations have combined to shift the thrust of surveillance and warning from a specialized, redundant set of collection platforms (narrowly focused on a two-sided scenario) toward a much more flexible and responsive set of assets to perform an unpredictable and varied mix of contingencies. Did the focus on the Cold War alone cause U.S. airborne reconnaissance assets to be in this predicament or were there other factors involved? The focus of U.S. defense strategy was undoubtedly on the former Soviet Union and the Warsaw Pact. However, several other factors contributed to this paradigm, including funding priorities, inter-Service mistrust and a lack of confidence, secrecy and compartmentalization, and the introduction of space-based systems, which were believed to be the future replacement of airbreathing reconnaissance assets.

The Cold War Evolution

Aerial reconnaissance was carried out on a small scale during the First World War, but like so many other military techniques really came into its own in World War II. During the Second World War, photographic reconnaissance was the primary source

of information.[3] Long before World War II ended, Western Allies were realizing that they had no way of observing the Soviet Union as its forces pushed into Eastern Europe. Although the United States, Great Britain, and the Soviet Union were allies fighting against the Axis Powers, the Soviet Union was viewed with mistrust by the two Western powers. When the war finally ended in 1945, the chief concern was to find some way of monitoring the threat of Communist forces. Airborne reconnaissance provided the obvious answer to this dilemma. Unhindered by any of the fighters the Soviet Union possessed at that time, the United States had the perfect vehicle in the high-altitude Boeing B-29 to conduct surveillance. When relations began to deteriorate between East and West, these aircraft were regularly dispatched over Soviet territory. The F-13A, later designated the RB-29A, conducted most of the photo missions; however, specialized variants began to emerge and the proliferation of specialized reconnaissance platforms and sensors began. For example, the B-29F was a lightened cold climate version equipped for 30 hours of tong range reconnaissance and designed specifically for operations in areas of Siberia. Furthermore, shorter range aircraft flew penetrations into East German airspace, and transports carried carefully hidden cameras along the air corridor to Berlin.[4]

When the Army-Air Force separated in 1947, it was agreed that the Army would handle its own photo interpretation and mass reproduction of photography flown by the Air Force.[5] During the cutbacks in the military budget in 1949, the Air Force sacrificed many tactical air units, resulting in a reduction of airborne reconnaissance to the equivalent of one group worldwide, consisting of one squadron with RF-80A photo planes, one strategic reconnaissance squadron with RB-29s, and a photo mapping flight with only two vintage RB-17s.[6] This resulted in a lack of necessary airborne assets to fulfill intelligence requirements in the 1950s to include reconnaissance support during the Korean War—most notably the Inchon amphibious landing operation. During the conception and early stages of planning for this operation, planners realized that no

imagery existed of the intended landing area. Initially, request for imagery went unanswered; then, only because representatives of Air Material Command were in theater to conduct a review of reconnaissance support did the requirement reach the 8th Tactical Reconnaissance Squadron (TRS) who supported it with RF-80A photo planes.[7] The commander of the 8th TRS had perceived problems with a lack of both funding and assets, and in a summary of the lessons from the Korean conflict wrote:

> Since one of the most critical times in reconnaissance requirements is that period at the outbreak of hostilities, I feel that our military effort was weakened greatly by trying to save money on reconnaissance between wars and not having the equipment available in using organizations when the demand was most critical.[8]

Funding Priorities

Mortgaging future and current capabilities to support current operations has been an ongoing process. The United States has experienced four downward cycles in defense spending in this century. These occurred after the conclusion of each major war that the United States has fought: World War I, World War II, the Korean War, and the Vietnam conflict. Expressed in fiscal year (FY) 1993 dollars, after World War I defense spending dropped from approximately $140 billion to less than $10 billion or 96 percent in real terms; after World War II from $900 billion to $70 billion or 92 percent; after Korea from $464 billion to $237 billion or 49 percent; and after the Vietnam war, from about $345 billion to $229 billion or 37 percent. With the end of the Cold War the trend has been no different than in the past. The current drawdown has seen defense procurement reduced by 50 percent and research and development investments by 20 percent, while operations have declined by only 25 percent.[9]

Funding for reconnaissance assets was, until recently, ignored by the Services. The intelligence community provided the funding to upgrade, develop, and procure airborne sensors and platforms through the Government Defense Intelligence Program (GDIP), the National Foreign Intelligence Program (NEW), and the Central Intelligence

Agency (CIA). Each agency would develop and purchase a small number of sensors associated with a single platform to fulfill its intelligence requirements, adding to the already growing problem of specialization and lack of interoperability. Currently, airborne reconnaissance assets compete for funding within the Service budgets and have began to suffer in this process.[10] For example, the Air Force deactivated the SR-71 as a result of high operating costs and lack of funding for sensor upgrades; the venerable RF-4C was transferred to the Air National Guard (ANG) and has been subsequently retired with no planned replacement. Due to age and lack of adequate funding, the C-130 PACER COIN imaging system was also turned over to the ANG and its funding has been offered up to be cut over other more vital assets; and finally, the RC- 135 RIVET JOINT was frozen at baseline upgrades for over two years, severely impacting its future collection capabilities. Additionally, the United States Army will retire the OV-1D MOHAWK in the fourth quarter of fiscal year 1996. The Services continue to retire/deactivate reconnaissance platforms with no investment in a follow-on or replacement system. The United States military is repeating the mistakes of the past. As it did in 1949, the Services are emphasizing spending for current operations as opposed to funding future investments, thereby placing the ability of the nation to handle both present and future crises in jeopardy.

Inter-Service Dynamics

Throughout history the separate Services have operated in their own limited spheres and for the most part collected information that they considered necessary to fulfill their own requirements. Airmen wanted intelligence and reconnaissance assets to collect on enemy fighter aircraft and air defense systems, whereas surface battle groups or tanks and armored personnel carriers were the main concern of the Navy and Army, respectfully. The reasons each Service designs to operate as independently as possible can be traced to a history of mistrust and lack of confidence among the Services. For

example, the Air Force failed to take into account Navy and Marine requirements when it designed and procured aerial refueling tankers for Strategic Air Command in the 1950s. Additionally, the Marines have insisted on having their own air force ever since the Navy abandoned them on Guadalcanal in 1942 and continue to voice disagreement over the integration of their air and land forces under air and land component commanders. Furthermore, the Army has developed the Advanced Tactical Missile System (ATACMS) to strike deeply into an adversary's rear area, despite the fact that the Air Force and Navy field hundreds of fighter and bomber aircraft to conduct that same mission.[11] The further the Services have had to depend on vital support from each other, the more they have sought to developed organic capabilities that respond to the anxiety of mistrust and confidence.

Reconnaissance assets have not been immune to this mistrust and lack of confidence. Although the Air Force had a robust airborne reconnaissance capability in theater during the Vietnam War, its unresponsiveness to Army and Marine requests for intelligence resulted in Army and Marine combat forces, in turn, relying on the Army's OV- 1 Mohawk reconnaissance system. The Army ultimately raised the problem to the commander and chief, Pacific Air Forces, who, in a message to the Seventh Air Force commander commented:[12]

> Army requests for Air Force reconnaissance, especially on high priority targets, continue to diminish. It appears that the Marines also tend to rely more on Mohawk coverage rather than our reconnaissance. Records [at] this headquarters reveal that reconnaissance request for the Army have in fact been on a decline for months…Primary reasons for decline in requests apparently based on generally slower Air Force response time.[13]

This "mistrust" trend continues today. Currently, the Army is fighting an initiative to replace the retiring OV-1D MOHAWK with an upgraded sensor package on the U-2.[14] The Army Staffs argument centers around command and control of the asset. The Army agreed that the U-2's capabilities far exceed that of the MOHAWK; however, they contend that since this is an Air Force platform (particularly a national asset), during a time of crisis and/or war it could be used elsewhere, as determined by others, and not support Army intelligence requirements. Furthermore, the Army has requested additional funds be acquired to enhance their EO-5B Airborne Reconnaissance Low (ARL) system in order to fulfill this requirement with an Army-owned and operated platform.

Secrecy and Compartmentalization

Secrecy and compartmentalization have led to the development and procurement of similar airborne sensors, resulting in assets that are described as being a somewhat specialized set of "stovepipe" systems. Basically, sensors are irrevocably tied to their platforms and associated ground stations, thereby, permitting no interchange between platforms for similar missions. The Air Force's SR-71, U-2, and RC-135 are prime examples of this phenomenon. All three were, until recently, highly classified systems; in fact, up to 1987, U-2 pilots were not authorized to know the capabilities of the sensors they carried or the intelligence obtained from missions they flew. As a result of secrecy, several different SIGINT sensor configurations for the U-2 can be used effectively only with that platform and processed only in specific ground stations. Additionally, RC- 135 information cannot be fused with this data due to a lack of communication interfaces or

equipment commonality. Secrecy resulted in identical "wet" film cameras for the U-2 and SR-71, but with no capability of interchange between platforms without large dollar amounts being invested. Furthermore, the Joint Surveillance Target Attack and Radar System (JSTARS), while not shrouded in secrecy, was developed with no attempt at integration with other platforms. Its ground station and datalink--the Enhanced Ground Station Module (EGSM) and the Self Contained Datalink (SCDL)--are unique and do not permit cross-queuing and fusion of data. The U-2 has developed a similar "JSTARS" capability, but again uses a unique datalink and ground processing station.

Introduction of Space-Based Platforms

With the successful launch and recovery of a satellite named Discover 14, on August 18, 1960, the United States became the first nation to have an orbital reconnaissance capability.[15] Airborne reconnaissance assets were then perceived to be obsolete and priority and funding shifted from developing airborne assets to maturing the overhead systems. Virtually everyone in the intelligence community believed that satellites were going to cause profound changes in the scope of collection. For the first time information would be accumulated on a global scale. Perceptions were that reconnaissance satellites would not be constrained by the limited "reach" of airbreathing platforms, cameras, and antennas.

Just as the aircraft had overtaken the balloon for the observation and reconnaissance mission, so would the satellite make airborne reconnaissance obsolete; however, this perception was flawed for several reasons. First, overhead systems were (and continue to be) more expensive to operate and maintain as compared to airborne systems. Second, airborne systems, with a relatively lower minimum operations tempo during peacetime, can be quickly retasked, relocated, and surge as necessary to meet crisis requirements. Conversely, satellite systems are capable of only a limited increase in operations tempo and tasking. However, a major surge is not possible without

increasing launch operations to put more satellites and sensors on orbit. Third, satellites continue to be highly classified systems causing problems in dissemination and releasability of overhead reconnaissance products. Finally, airborne assets can provide long-dwell and immediate response to a combatant commander's intelligence requirements, whereas overhead assets cannot.[16] As Martin C. Faga, Director of the National Reconnaissance Office (NRO) stated:

> People have the idea that satellites can [absorb] almost everything. Actually it's just a sip from the ocean of information, and we're dipping with a thimble. We cover the world, but the information gathered in any particular location or frequency spectrum is limited.[17]

Both systems--overhead and airborne--have inherent limitations; however, they provide a balanced and complementary mix, each contributing essential information throughout the spectrum of conflict.

From its humble beginnings, airborne reconnaissance assets have developed into a specialized and relatively highly capable set of platforms serving specific users. A focus on strategic reconnaissance against the Soviet Union, funding, mistrust, secrecy, and competition with overhead assets has severely impacted the efficiency of the airborne reconnaissance fleet. This legacy continues to haunt the intelligence community and the airborne reconnaissance fleet as highlighted in the Persian Gulf War.

Chapter 3

AIRBORNE RECONNAISSANCE SHORTFALLS AND DEFICIENCIES IN DESERT SHIELD/STORM

> The United States relies on the Air Force, and the Air Force has never been the decisive factor in the history of warfare.
>
> Saddam Hussein
> 30 August 1990

During the Persian Gulf War, air power accomplished exactly what airpower visionaries said it could do. Within a few weeks of bombing, Iraqi towns and cities were hardly damaged; however, Iraq's military power was seriously disrupted. Within 48 hours after the start of the air campaign military communications were degraded, Iraqi air defenses were incapacitated, and the Iraqi population was deprived of electricity, telephone, and water. During the next few weeks, the Iraqi army was cut off from food, fuel, and ammunition resupply by the destruction of rail and road bridges.[18] The results of the air campaign were impressive; however, the shortcomings of U.S. airborne reconnaissance were troubling. While reconnaissance capabilities were important in expediting the victory during DESERT SHIELD/STORM, that experience highlighted important shortfalls and deficiencies in the overall reconnaissance community.

During DESERT SHIELD/STORM, over 80 percent of all airborne reconnaissance assets were deployed to support SIGINT and IMINT requirements; however, these assets were only able to satisfy a fraction of the overall intelligence requirement.[19] The Persian Gulf War revealed the shortfalls and deficiencies of airborne reconnaissance that require corrective action to ensure the warfighter's intelligence requirements are met.

Broad Area Coverage

Two dominating imagery shortfalls were the lack of broad area coverage and the need for assured delivery of intelligence to warfighting commanders. As a result of the Cold War focus on the Soviet Union, airborne reconnaissance sensors were focused on fixed targets, producing a capability to deliver high resolution, spot coverage in near-realtime to specific users. The inability to deliver large area coverage during the planning phase of DESERT SHIELD and the inability to locate and target missiles during DESERT STORM were major deficiencies in airborne reconnaissance capabilities.[20] During the conflict, the only broad area imagery collector in the reconnaissance fleet was the U-2 configured with either an Optical Bar Camera (OBC) or an Intelligence Reconnaissance Imaging System (IRIS) camera. These two systems were relatively old and limited by weather and lighting conditions (i.e., sun angles), and since they were "wet" film-based camera systems, they had a 4 to 48-hour processing delay that did not meet timeline requirements. As a result, required imagery reached commanders too late to affect their decision and planning cycles.

Exploitation Throughput

Even if adequate broad area coverage were available, there still would have been a major shortfall in the resources necessary to exploit that coverage. Exploitation throughput was a major deficiency as a result of two factors. First, precision guided munitions dramatically increased the operator's need for high-resolution imagery. And, second, system affordability dictated the need for a relatively limited number of ground processing and exploitation vans.[21] For instance, the SENIOR YEAR Electro-Optical Reconnaissance System (SYERS) and its ground station (SENIOR BLADE) contain only four processing positions and no other imagery ground station could process the SYERS data, producing a backlog of imagery requests and the slow exploitation of raw electro-optical imagery.

Timeliness

Warfighting commanders during DESERT STORM required timely data to support them in the execution of the decision cycle and their missions. The most critical timelines were the decision windows which were driven by the need to find and destroy mobile weapons or other targets that had short physical or political vulnerability. Additionally, the requirement to strike a target, assess the damage to that target, and restrike if necessary placed time restrictions on the collection platform. The collection of the intelligence data needed to occur post-strike, but be received by the user in time to support his/her decision to restrike. At any given time, CENTAF's planners were running three wars; one was the execution war (what's being done today); another was the Air Tasking Order or ATO (what's happening tomorrow); and third was the planning phase (what will happen the day after tomorrow). Accurate and timely intelligence was vital to all of these. Deficiencies in exploitation throughput and timeliness combined with intelligence analysts' under estimations of destroyed Iraqi weaponry might have unnecessarily prolonged the air campaign by revisiting destroyed targets and unnecessarily endangering the lives of aircrews.[22]

Collection Quality/Resolution

Collection quality or imagery resolution has plagued airborne reconnaissance designers, analysts, and commanders for quite some time. After the Gulf War, the Services and Combatant Commands published documents defining their quality requirements; however, not all mission areas required high-resolution imagery. For example, broad area coverage to support route planning and intelligence preparation of the battlefield generally required an average resolution, while targeting and BDA were dependent on higher resolutions.

Two classic examples of inadequate collection quality during DESERT STORM were the shelter-busting campaign and the tank-plinking effort. When coalition strike aircraft hit Iraqi hardened aircraft shelters with penetrating laser-guided bombs, the

shelter often contained the resulting explosion. Often, the strike video would show the bomb hitting the shelter; however, the reconnaissance overflight, often hours after the strike, would show what appeared to be an intact or slightly nicked shelter with perhaps a small hole in its roof. This would cause intelligence assessors to consider it only partially damaged at best, or perhaps not damaged at all, while, in fact, the shelter and the aircraft inside were completely destroyed. During attacks on Iraqi armor, often a bomb, missile, or cannon round would destroy a Soviet-designed T-72 tank, leaving only a small hole, but completely destroying the interior. After the tank "brewed up" and the fires burned out, airborne reconnaissance sensors imaging the tank could not reliably indicate whether in fact it had been damaged or destroyed.[23]

Geolocational Accuracies

The advent of precision guided munitions and computer-based mission planning systems have increased the need for all-weather, medium to high resolution imagery with precision geolocations of objects on the battlefield. Based on the *Assured Support to Operational Commanders* requirements document, the most stringent operational intelligence requirement for geolocation accuracy is classified. However, it can be assumed that none of the airborne, or for that matter, overhead systems meet this requirement.[24] Targeting and BDA will continue to drive the requirements for accurate geolocations. Additionally, there is a need to couple the accuracy of reconnaissance systems with the accuracy of current and future precision weapons.[25]

Assured Delivery

The Gulf War highlighted the need for timely imagery available to execution-level combat forces, Quality imagery at the right time was needed by the weapons planning staff, the pilots who flew the missions, and by the ground combat forces. During DESERT SHIELD/STORM, large amounts of imagery were collected, processed, exploited, and disseminated; however, limited communications and a military

doctrine that did not stress the need for intelligence at the execution level led to intelligence data being routinely limited to distribution at higher levels of command.[26]

CHAPTER 4

AIRBORNE RECONNAISSANCE: CURRENT SYSTEM INADEQUACIES

> The functions of reconnaissance aviation is to secure information by visual and photographic means and to return this information for exploitation.
>
> Army Air Force Field Manual 100-20
> Command and Employment of Airpower
> 21 July 1943

As discussed earlier, airborne reconnaissance assets evolved into self-contained systems, designed to provide a specific intelligence product to a specific user; hence, the term "stovepipe" systems. The Gulf War emphasized, instead, the need for an "end-to-end" cycle to include tasking, collection, processing, exploitation, and dissemination, However, the current airborne reconnaissance fleet is unable to meet this requirement for four reasons: an inadequate force structure and lack of interoperability; missionized platforms and sensors; ground stations and datalinks; and finally, platform survivability.

Force Structure and Interoperability

The current reconnaissance force structure is continuing to decline with associated defense cuts. Since 1990, a gradual reduction in Service wide reconnaissance force structure has occurred due to budget cuts and the age of certain platforms. The Army, Air Force, and Marine Corps airborne reconnaissance forces decreased by 20%, 58%, and 81%, respectively as compared to their 1990 highs (see Table 3-1). Navy assets increased by 11%, due to the introduction of the P-3B/C REEF POINT, the ES-3A, and two Pioneer Unmanned Aerial Vehicle (UAV) units; however, total numbers peaked in 1992 and are currently starting to decline.[27] This decline continues with the planned retirement of the OV- 1D Mohawk system in 1996, the loss of four U-2 aircraft in the past four years due to mishaps, and the cancellation of the Advanced Tactical

Airborne Reconnaissance System (ATARS) by the USAF on 21 September 1993. Additionally, the Department of Defense is considering "moth-balling" the C-130 SENIOR SCOUT and SENIOR TROOP reconnaissance systems within the next two years.[28]

Reconnaissance Force Structure

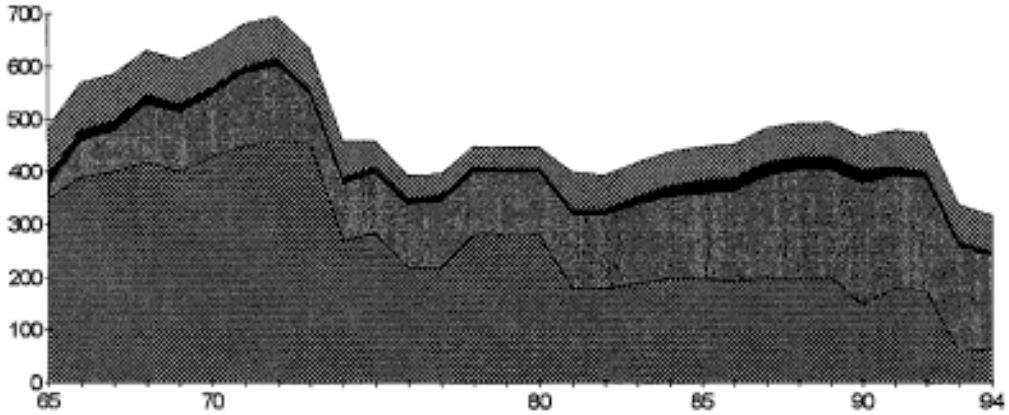

Table 3-1

Even if the airborne reconnaissance force structure had not declined after 1990, there still would be shortfalls, In addition to having a sufficient number of platforms, there must be a proper mix of commonality and interoperability among reconnaissance assets; however, from a system's perspective, the reconnaissance community has too many unique airframes, sensors, and ground stations. During the Gulf War, 33 unique IMINT systems (14 of which were not interoperable), 18 different SIGINT systems, three radar intelligence systems and three MASINT systems were deployed, causing interoperability, tasking, and dissemination problems.[29] Additionally, one area where the Air Force suffered from an overabundance of different systems was imagery dissemination. More than a dozen secondary imagery systems supported headquarters U.S. Central Command and its components during the conflict. Very few of these were

compatible because they were not equipped with the national imagery transmission format or common communications protocols. The effect from this mixture of systems was time delays in distribution of time-critical imagery or imagery-derived intelligence.[30]

Missionized Platforms and Sensors

Airborne reconnaissance platforms were irrevocably bound to sensors which were, in turn, tied to a specific ground station. The reasons for this deficiency were outlined in Chapter One. The characteristics that drove platform-sensor-ground station relationships began with hard requirements. For example, the requirement for high-quality, day/night, all-weather imagery drove the development of a series of Synthetic Aperture Radars (SAR). The radars were designed for a certain class of aircraft, which dictated weight, power, and size requirements. The user's need for near-real-time intelligence drove the requirement for the current mix of SAR processors and exploitation ground stations. These reconnaissance systems were good collector, processor, and delivery systems for a specific set of users, generally within the Service chain of command of the systems developers. However, they did not allow for the "end-to-end" cycle from tasking to dissemination for all possible users.[31] Prime examples of this are the Air Force's U-2 and JSTARS systems, and the Army's OV-1D Mohawk. Each have SAR sensors built by different defense contractors (Hughes Aircraft Corporation, Grumman, and Westinghouse, respectively); each have unique SAR processors; and each have different ground stations (the Contingency Airborne Reconnaissance System (CARS), the EGSM, and the OSM, respectively); hence, none of these systems is interoperable.

Ground Stations and Datalinks

Throughput and timeliness deficiencies discussed in Chapter Three are linked to the third shortfall of reconnaissance systems--ground stations and datalinks. Most of

today's ground stations are limited to processing data from one sensor, have too few exploitation positions, are expensive to develop and operate, and are neither mobile nor easily transportable. As a result of its versatility and superior capabilities, the U-2 reconnaissance system may be the worst offender of all airborne reconnaissance assets with respect to ground stations. The modular payload capability of the U-2 enables a wide variety of IMINT and SIGINT sensors to be employed, requiring unique ground station support for processing and exploitation. During the Gulf War, the small number of U-2 ground stations (e.g. two SYERS and two Advanced Synthetic Aperture Radar System (ASARS)) combined with the enormous amount of imagery requests and lack of sufficient exploitation stations severely impacted the throughput, timeliness, and efficiency of intelligence products. Since DESERT SHIELD/STORM, U-2 ground stations have been consolidated into the CARS; however, CARS still only services the U-2 platform and its associated sensors.

Datalink interoperability and commonality is an important subset of the sensor-ground station shortfall. A major effort has been under way since the 1970s to field a family of common datalinks; however, the problem was not solved prior to, during, or after the Gulf War. Currently, there are 17 different line-of-sight and over-the-horizon collection datalinks employed on airborne reconnaissance assets. Additionally, there are 15 unique dissemination links currently employed.[32] Each datalink is unique and tied to a particular sensor compounding the lack of interoperability and cross-queuing of intelligence data.

Platform Survivability

From a system's perspective, the fourth and final shortfall deals with platform survivability. Survivability has long been considered the "Achilles heel" of airborne reconnaissance, dictating long stand-off ranges, high value asset escort, or even mission cancellation.[33] Obtaining air superiority quickly in the desert limited this shortfall's

impact. Reconnaissance missions were relatively safe during DESERT STORM, but were at risk during DESERT SHIELD and the coalition's military build-up phase. As a result, airborne reconnaissance assets were unable to fully conduct operations to assist in the intelligence preparation of the battlefield prior to hostilities. Additionally, reconnaissance missions were limited until air superiority was attained, and even then they required fighter escort, AWACS, and RC- 135 RIVET JOINT support, restraining these limited theater assets. Self protection measures are extremely important not only for protection of the platform, sensor, and the technologies involved, but also in freeing up limited combat assets that could be used more efficiently elsewhere.

History reflects the "why,""where," and "how" airborne reconnaissance systems inherited its legacy of shortfalls and deficiencies and the Persian Gulf War reinforced the requirements of the warfighter. This chapter highlighted current system shortfalls and problems, which require correction if airborne reconnaissance is to fulfill future intelligence requirements. All that remains is "who." Who will fix this complex set of problems before the next "when" occurs?

CHAPTER 4

DEFENSE AIRBORNE RECONNAISSANCE OFFICE, FRIEND OR FOE?

> …the Defense Airborne Reconnaissance Office (DARO) was created to manage the development and acquisition of all joint and Defense-wide airborne reconnaissance activities. I believe that such an organization must carefully examine our reconnaissance needs and capabilities and produce a unified architecture that can support the tactical intelligence needs of military operations. Their efforts must balance collection, processing and dissemination technologies against prudent investment strategies as well as vital contributions of our allies in the prosecution of future conflicts. I view the creation of the DARO as a proper step that will serve to focus our efforts on this critical mission.
>
> The Honorable William J. Perry
> Secretary of Defense
> Congressional Testimony 2-94

On November 6, 1993, the Deputy Secretary of Defense created the Defense Airborne Reconnaissance Office (DARO) to unify the existing airborne reconnaissance architectures and enhance the management and acquisition of manned and unmanned airborne assets in an effort to correct the deficiencies and shortfalls highlighted in the Gulf War.[34] Is the DARO capable of correcting the problems and shortfalls with airborne reconnaissance platforms, sensors, datalinks and/or communications, and ground stations? The answer appears to be yes; however, major problems associated with this agency are impacting its ability to operate effectively.

The DARO and its Vision

The Department of Defense Directive that established the DARO's responsibilities, functions, relationships, and authority describe the DARO not as a member of the intelligence community, but as a development and acquisition organization with no operational control over any airborne reconnaissance asset. The DARO's mission is to provide effective and coordinated management of all airborne reconnaissance programs, in response to the needs of the warfighter. Accordingly, the

DARO is responsible for the development and acquisition of airborne reconnaissance platforms, sensors, datalinks, and data relays and ground stations. Additionally, working with the Services and Agencies will define development, acquisition, and investment strategies for Joint Service and Defense-wide airborne reconnaissance activities, including developing associated fiscal guidance for the Services/Agencies.[35]

The DARO was tasked to assess the airborne reconnaissance needs of the U.S. through 2010 and to develop and implement the strategy to meet those needs in a timely and cost-effective manner. To accomplish this task, the DARO introduced the goal of *extended reconnaissance*--"the ability to supply responsive and sustained intelligence data from anywhere within enemy territory, day or night, regardless of weather, as the needs of the warfighter dictate."[36] To achieve this goal, the DARO outlined a systematic approach for selecting, developing, and deploying the specific platforms, sensors, communications, and information technologies that would be required to transition from the current airborne reconnaissance architecture to the *Objective Architecture.* The *Objective Architecture* is a blueprint for an interoperable system that will be flexible and scaleable. “It [will] consists of a balanced mix of manned and unmanned platforms supported by an efficient global information infrastructure to minimize redundant data collection and expedite the delivery of reconnaissance data with particular emphasis on the direct connection between the sensors and the warfighters."[37]

The *Objective Architecture* addresses the shortfalls and deficiencies highlighted by the Gulf War. However, it falls short of the mark for several reasons. First, the individual Services have not completely endorsed the *Objective Architecture.* Second, all reconnaissance assets do not fall under the DAROs purview, limiting its effectiveness to enforce the architecture and system commonality. And, finally, the current reconnaissance force structure was slowly raped of its funding to support current DARO initiatives, creating a "reconnaissance capabilities gap."

The Services and DARO

The solution to the first segment of this problem, the retention of Service control of assets, appears simple enough; however, it will require the Services to undergo a cultural change. Each of the Services must unshackle its historical tendencies of mistrust and formally sign up to the DARO's *Objective Architecture* and investment strategies. This cultural evolution and sense of trust will not come easy. However, it is an essential part to solving the current "stovepipe" model of airborne reconnaissance. The Services bias must cease, since reconnaissance has become a shared responsibility. The battlefield has become multi-spectral, mutli-spacial, and severely time compressed, the requirement to drive the data volume down and the information content up means there must be an appreciation of who is doing what on the battlefield. The DARO has put together an architecture that basically is balanced in terms of types of coverage, responsiveness to timelines, superior exploitation, and an adequate communications system to support intelligence requests and dissemination.

For the first time in the history of airborne reconnaissance there is a document that encompasses and attempts to integrate all Department of Defense airborne reconnaissance assets that the Services need to either support or reject. With respect to the Services support of the *Integrated Airborne Reconnaissance Strategy,* Maj General Kenneth Israel, the current Director of the DARO commented:

> The Services have recognized [the architecture], and that's the best you can hope for now. They have recognized what the *Integrated Airborne Reconnaissance Strategy* is. They recognize the problems of airborne reconnaissance--in a more enlightened fashion, because they have more data available to them--they can choose either to embrace [the architecture] or offer viable recommendations on how it should be modified. An architecture is not something that once you define it and develop, never changes. An architecture is dynamic--it should [be].[38]

This is exactly what has occurred between the DARO and the Air Force. HQ USAF, Directorate of Forces (XOF), argued successfully that in order to obtain the architectural goal of *extended reconnaissance,* the U-2 and RC- 135 platforms required continued enhancement and upgrades. The U-2 program lost funding for three major

sensor upgrades after it was transferred under the purview of the DARO. Additionally, the RC- 135 programmed baseline sensor upgrades were stopped and funding diverted for other DARO initiatives. XOF challenged the DARO on the investment strategy concerning the architecture and introduced valid recommendations and modifications to the strategy in terms of funding for these two programs. The result of this "check and balance" between an Office of the Secretary of Defense and a Service Headquarters produced cost effective, commercial off-the-shelf (COTS) sensor upgrades to SAR and electro-optical systems that begin to address broad area coverage, collection quality, and geolocation accuracy for the warfighter, while enforcing commonality and interoperability from a system's perspective (see Table 4-1).[39]

Airborne Reconnaissance Shortfalls

Warfighter's Perspective	**System's Perspective**
Broad area coverage	Inadequate Force Structure
Exploitation throughput	Sensors tied to Platforms
Timeliness	Platforms-sensors tied to ground stations
Collection Quality	Single Discipline datalinks and ground stations
Geolocation accuracy	Survivability
_Assured delivery	

Table 4-1

Additionally, "blood-letting" over ground stations has led to the migration of the Common Imagery Ground/Surface System (CIGSS) concept which will address shortfalls in exploitation throughput, timeliness, and assured delivery by migrating eight existing ground stations to a common, interoperable multi-user baseline.[40] Furthermore, RC-135 baseline upgrades have been funded and a combined DARO-Joint Program Office (JPO) program is underway to consolidate RC-135, U-2, and the Navy's EP-3 SIGINT sensors and equipment to a common modular and scaleable baseline.

The DARO's *Integrated Airborne Reconnaissance Strategy* takes a vision of the

battlefield and decomposes it in terms of where the shortfalls in reconnaissance are and supports initiatives that take care of those shortfalls by ensuring an open architecture that uses off-the-shelf components guaranteeing interpretability, commonality, and responsiveness. Besides consolidating collection systems and significantly improving links between reconnaissance assets and weapons, the DARO is also placing much emphasis on streamlining the means by which intelligence is stored, retrieved and distributed. This is exactly what is required to fulfill the intelligence needs of the warfighter. Why then, are the Services so cautious about the architecture and the DARO? When the DARO was stood up in November 1993, the airborne reconnaissance programs placed under the DARO (i.e. U-2 and RC-135) had funding stripped away from future upgrades to be used, instead--from a Service perspective--to create the UAV programs. Whether this perception is based on fact or fiction is immaterial, but what is important is that the Services saw a threat to their "roles and mission" and, more importantly, to their funding lines, thereby causing mistrust between the DARO and each Service. Besides the threat to "roles and mission" perceived by the Services, the problem may be in the DARO itself. The DARO is a relatively young and small office. Its staff is drawn roughly equally from USAF, Navy/Marine Corps, and Army personnel. However, a majority of the work is accomplished by defense contractors. This leaves a sour taste in the mouth of the Services who believe that military members should be the ones defining military requirements. Additionally, a major stumbling block in the cultural change that is required is the issue of manned versus unmanned platforms. This strikes right at the soul of the warfighter, who views unmanned platforms as a threat to his/her profession. Debates rage with emotions with respect to this issue. However, with respect to manned versus unmanned platforms, Gen Israel commented:

> There is the need for both [manned and unmanned] because having a man in the loop [he or she] can always take action to do things we haven't thought of before or notice developments and patterns on the battlefield instantly because of his/her cognizant skills. We haven't put artificial intelligence into any kind of UAV. It is not a question of one versus the other at this time. There is more than enough enemy Out there for everybody.[41]

The second segment of the problem associated with the DARO and the Services is that not all airborne reconnaissance systems fall under the DARO's oversight, limiting the effectiveness of enforcing the migration from the current architecture to the *Objective Architecture.* Table 4-2 shows the airborne reconnaissance assets that are currently under the DARO's responsibility and those assets that are currently under Service functional/programmatic responsibility. It becomes apparent that if the *Objective Architecture* is to be reached, it will require centralized control of development, procurement, and modifications/upgrades of these assets. The DARO should be that agency with the Services maintaining operational control over the same assets.

Reconnaissance and Surveillance Asset	DARO Responsibility	Service Responsibility
U-2 DRAGON LAD	****	
RC-13SU COMBAT SENT	****	
RC-135VNV RIVET JOINT	****	
EP-3E ARIES II	****	
ES-3A SHADOW		****
RC-12 GUARDRAIL		****
EH-60 QUICKFIX		****
RVAD QUICKLOOK		****
C-130 SENIOR SCOUT		****
RC-135S COBRA BALL	****	
RC-135X COBRA EYE	****	
P-3B/C REEF POINT		****
F/A -18 HORNET (RC)		****
F-14 TOMCAT/TARPS		****
C-130 PACER COIN		****
EO-513 ARL	****	
OV-1D MOHAWK		****
E-8C JSTARS		****
E-2C HAWKEYE		****
JSIPS	****	
N-JSIPS	****	
MIES	****	
TRAC/ETRAC	****	
CARS	****	
ROFA	****	
BGPHES-ST		****
IPF		****
PPIF		****
TERPES		****

Table 4-2

All current and future acquisition, development, and modifications of airborne reconnaissance assets must fall under the purview of the DARO. The Services must articulate their requirements to the DARO and work closely with them, to ensure these

requirements are being met. This will force commonality between sensors and exploitation systems and eliminate unnecessary redundancy. At present, basically the only policing function the DARO has available in order to get the Services to recognize or not to recognize the architecture is to control the funds. If the DARO controls the funds, it can control compliance with the architecture. If the DARO does not control the funds, all it will get from the Services is a seal of approval, but no real compliance.

The Services, DARO, and Funding

With a declining defense budget, not only does force structure decline, but so doe available resources. As weapon systems become much more expensive, the Department of Defense is going to have fewer discretionary funds to share with airborne reconnaissance assets. It is therefore incumbent upon the Services and DARO to have an affordable and obtainable architecture that increases efficiency and capability. The DARO has outlined such a strategy and it is now up to the Services to work with the DARO, not against it, and to provide "sanity checks" when necessary.

A "reconnaissance capabilities gap" has developed due to budget constraints and cutbacks. Chapter One discussed the historical trend of defense budget reductions and its relationship to airborne reconnaissance capability. Under-funding had already begun to decimate airborne reconnaissance readiness, force structure, maintainability, and sustainability before November 6, 1993. On that date, when the DARO took control of certain airborne reconnaissance programs, it aggravated the problem by making system-level tradeoffs between current airborne reconnaissance systems upgrades/modifications and new initiatives. The Deputy Under Secretary of Defense for Advanced Technology (DUSD(AT)) realized that current systems would have to be streamlined and consolidated in order to yield funds for critical new initiatives from within the declining defense budget. DUSD(AT) and DARO's purpose was to create an integrated, affordable, supportable, consolidated airborne reconnaissance capability of the highest possible quality in order to meet the National and Joint Service prioritized requirements.

However, in their haste to begin, they sacrificed planned upgrades to current platforms and sensors restricting the fulfillment of intelligence requirements. The Services and the intelligence community have utilized an "evolutionary" approach toward airborne reconnaissance modifications, upgrades, and new procurement. By enhancing reconnaissance systems slowly, as the threat changed, the price was kept within reason. The DARO's approach, on the other hand, is more "revolutionary--canceling or placing a freeze on all modifications and new acquisitions, and placing all emphasis on the Advanced Concept Technology Demonstrations (ACTDs).

This has resulted in a gap between reconnaissance capabilities and threat requirements. The major near-term threats to United States security include Iraq, Iran, and North Korea. These threats are minor compared to future strategic challenges that face the United States and its allies if they cannot arrest the proliferation of weapons of mass destruction and advanced military technologies to Third World nations. Although this news is bleak, officials believe such challenges to United States security lie at least a decade away.[42] However, the key to confronting and countering these future threats rests with the military and political leaders' decisions of today. If the DARO does not properly balance the continued enhancements of current systems and funding for future investments, the ability of airborne reconnaissance to handle present and future intelligence crisis could be in jeopardy.

Recommendation

The *Objective Architecture* and the goal of *extended reconnaissance* is an excellent beginning toward the challenges of platform, sensor, communications, and dissemination interoperability. This architecture must be interactive and a coordinated effort among the Services, intelligence agencies, and the DARO is imperative. The DARO must continue to work with these agencies to ensure that warfighters at all levels of command have ample opportunity to articulate their mission requirements for airborne reconnaissance systems and products. In addition, the DARO must build trust and

confidence with members of the defense community, while the Services must begin to work closely with the DARO to ensure requirements are being met efficiently and as rapidly as possible. Additionally, all current and future acquisition, development, and modifications of airborne reconnaissance assets must fall under the purview of the DARO. This will force commonality between sensors and exploitation systems and eliminate unnecessary redundancy.

CHAPTER *5*

AIRBORNE RECONNAISSANCE DOCTRINIE, ORGANIZATION, AND TRAINING IN A JOINT ENVIRONMENT

> We see clearly that the activities characteristic of war may be split into two main categories: those that are merely preparation for war, and war proper. The same distinction must be made in theory as well... . The knowledge and skills involved in the preparation will be concerned with creation, training, and maintenance of the fighting forces... . The theory of war proper, on the other hand, is concerned with the use of these means, once they have been developed, for the purpose of the war.
>
> Carl Von Clausewitz
> *On War*

Up to this point, the focus of this paper has been on airborne reconnaissance with respect to equipment (i.e., platforms, sensors, datalinks, and ground stations); however, this is only one portion of the overall problem. Equipment enhancements and technological advances by themselves are not enough to achieve the DARO's goal of *extended reconnaissance* or to satisfy the warfighter's needs. Profound change in airborne reconnaissance can only occur with an associated change in doctrine, organization, and training. Only then can the benefits of improved equipment be realized and passed on to the warfighter. During DESERT SHIELD/STORM, airborne reconnaissance systems were somewhat capable: however, the joint operational reconnaissance process was unprepared for the war. Modern warfare requires US forces to fight as a joint team whether operating unilaterally or as part of an international coalition. Historically, airborne reconnaissance assets have conducted operations "ad hoc" and though Service channels. However, the Gulf War demonstrated the requirement for airborne reconnaissance assets to be fully integrated and synchronized into a Joint Task Force (JTF) to achieve strategic and operational goals. In order to discern the problems associated with the capabilities/limitations of airborne reconnaissance in a joint environment and develop corrective action requires an

understanding of the JTF, the intelligence cycle, and the tasking process.

The Joint Task Force

The JTF is an organization created to conduct joint force operations that achieve operational-level goals. Typically, the JTF consists of a combination of service and functional components from the Army, Air Force, Navy, and Marine Corps. The Joint Force Commander (JFC) organizes the JTF based on the mission objectives dictated by the JTF-establishing authority and will have Operational Control (OPCON) over assigned and normally attached forces.[43] The JFC will establish intelligence requirements, determine the concept of employment for reconnaissance assets, and articulate this to the Joint Force Intelligence Officer (J2). The J2 is responsible for reviewing, validating, and coordinating requests for intelligence or information, while developing an integrated, synchronized intelligence collection strategy to satisfy the JTF mission objectives. Close coordination between the J2 and the Joint Force Operations Officer (J3) is required to satisfy intelligence and reconnaissance requirements. The J3's responsibilities include managing available resources to ensure maximum employment of critical assets to fulfill the reconnaissance objectives.[44]

Joint reconnaissance operations are dependent on numerous variables, such as platform availability, type of sensor, and information requested. However, if the intelligence staff is not organized and efficient, then no amount of reconnaissance information will achieve positive results. U.S. Central Command's (CENTCOM's) J2 staff was already at a disadvantage in August 1990, when Iraq invaded Kuwait, because they did not have a fully manned Joint Intelligence Center (JIC). A fully manned JIC was created prior to the start of the DESERT STORM campaign. However, even then it was still hindered because there was also no standing Joint Reconnaissance Center within the J3 staff. When CENTCOM did organize the JRC, they attached it directly to the JIC, instead of to the J3 as outlined in joint doctrine,

When the air operations began on 16 January 1991, CENTCOM's staff had a fully manned JIC and JRC under the 12. As a result, the 12 had responsibility for not only establishing the requirement for information, but also for determining how to collect the information. CENTCOM believed this allowed "direct and effective contact between the reconnaissance and intelligence platform managers, collection managers, and the theater-level intelligence analysts who needed timely information to respond to CINCCENT's requirements."[45] This arrangement might have worked in a more rigid environment. However, "given the lack of experience in combat reconnaissance, no previous joint training, unequal Service representation, and an extremely high demand for BDA imagery, the 12 was set for mediocrity."[46]

The Intelligence Cycle

Airborne reconnaissance operations are very much dependent upon the intelligence cycle, which consists of five separate phases: planning and direction, collection, processing, production, and dissemination.[47] Lessons from DESERT SHIELD/STORM indicated that some combat commanders were not aware of the intelligence process, capabilities, and limitations.[48] Commanders at all levels request intelligence or intelligence-related information by submitting a Request for Information (RI) and it is important to understand the actions that occur within the intelligence cycle in order to obtain the most from reconnaissance operations. Joint Pub 2-0, *Joint Doctrine for Intelligence Support to Operations,* defines the intelligence cycle as "the process by which information is converted into intelligence and made available to the user.

Planning and Direction. The first step in the intelligence cycle consists of identifying, prioritizing, and validating intelligence requirements. The operational commander establishes guidance for creating a baseline of intelligence requirements and identifies essential elements of information. Intelligence requirements and requests for information from within the entire JTF are then prioritized and aligned against collection capabilities. The final step is validation, which determines the actual military benefit of a

request and if it can be collected with available assets (or if it has already been acquired). Once validated and prioritized, a collection plan is completed and resources are tasked.[50]

This phase appeared to run effectively during the Gulf War. However, the Services were not prepared to communicate with the JIC, the JRC, or each other, because there had been no "pre-offensive training" to exercise the system to ensure that reconnaissance command/communication architectures would work in combat. A lack of communication resulted in many instances of redundancy and inefficiency in this phase and in the collection phase of the cycle as well. For example, the JIC and JRC were not aware of the F-14 TARPS capability and were not planning on utilizing it. Additionally, "a serious shortfall the Marines faced was the absence of an airborne reconnaissance platform able to provide imagery responsive to ground commanders' requirements." Although the airfield from which the Marines operated was also the home of the Air Force's tactical reconnaissance RF-4s, yet not one piece of imagery exchanged hands[51] due to lack of communication between the Services and the JTF staff.

Collection. In this step, the intelligence staff establishes the collection requirements and coordinates with operations on execution. Raw data is collected and transferred to a processing and production facility. Close coordination between operations planners and intelligence collection managers is essential to facilitate optimum use of limited collection assets. In the context of airborne reconnaissance operations, a platform and sensor system are tasked for a collection mission by the intelligence staff. The operations planners manage available airborne assets and compare platform capabilities against mission goals, the operational environment, and available resources. Satisfied that the tasking accomplishes the collection objectives, the mission is planned and executed.[52]

The apparent need for instant BDA reduced the overall efficiency of tasking collection missions. As a result of the inefficient organizational structure of the JRC under the J2, the JRC did not maintain centralized control of airborne collection assets

and tasking was delegated to the component commanders. Randomly-assigned photo missions selected from a list of required missions without a preconceived plan was just one result of a lack of centralized control for airborne reconnaissance systems.[53] This process was thought to be effective because targets were being collected on; however, it did not take into account what other Services/platforms were accomplishing, resulting in redundancy. For example, prior to the ground war, while mapping an Iraqi defensive line, a Navy reconnaissance asset noticed an Air Force RF-4 imaging the same targets.[54] This lack of coordination put one too many aircrews and platforms at risk when it was not necessary.

Additionally, planners were not aware of or prepared to employ advanced reconnaissance systems that participated in the conflict. DESERT SHIELD/STORM witnessed the first use of the U-2, RC-135, JSTARS, and the Navy's EP-3 in the tactical battlefield role.[55] The U-2 and RC-135 assets were under SRO procedures (PARPRO at that time) and required JCS/OSD approval for each mission. Lack of centralized control made it difficult to create a coherent airborne reconnaissance plan.

Processing and Production. This segment converts data into formats that can be used by intelligence personnel. Evolving technologies have produced some on-board processing capabilities which enable near-real-time intelligence to be passed directly to the user from the collection system. Examples of processing are photographic development, video production, format conversions as in the case of radar intelligence, and computer applications. Joint Pub 2-0, defines production as "the integration, evaluation, analysis, and interpretation of information from single or multiple sources into finished intelligence for known or anticipated military and related national security consumer requirements."[56] Intelligence products derived from reconnaissance operations appear in four basic types: verbal, textual, visual, and on-line.

With the exception of the U-2, all reconnaissance imagery products could be produced in one form or another. However, the capability to process and produce the

sheer volume of requested imagery was inadequate to meet the demand. U-2 "wet" film, moreover, had to be transferred to processing facilities in the U.S. because no processing facility in the AOR could develop its film. This process took over 36 hours. Additionally, RF-4 processing and production had unnecessary time delays built in as a result of the processing facility's being located in Riyadh, instead of being collocated with the operational unit stationed in Bahrain.[57] The immense number of requests, coupled with the duplication of effort caused by the disjointed tasking process, created massive amounts of film to be processed. Aggravating the situation were the inherent time delays in the processing and production phase caused by not fully understanding this segment of the intelligence cycle.

Collocating the RF-4's Photo Interpretation Facility (PIF) with the operational unit would have decreased time and improved efficiency. Additionally, due to budget constraints, the U-2's Mobile Imagery Processing Element (MIPE) was in the process of being deactivated prior to the Gulf crisis. However, if it would have been available it should have also been collocated with the U-2 operation in Saudi Arabia. In organizational terms, if the JIC had been in control of all the requests, it would have been able to combine missions as well as ensure that duplicate missions were not flown. This streamlining would have contributed to reduce the amount of film being processed and ultimately reaching the user.[58]

Dissemination. This final step in the intelligence cycle, dissemination, was assessed as "an intelligence failure during DESERT SHIELD/STORM" because of "the inability to provide intelligence quickly and reliably to warfighters throughout the theater of operations."[59] Dissemination is the most critical step in the cycle because it conveys the collected, processed, and produced intelligence to the requester in a usable form.

A major problem with the dissemination phase was interoperability. However, another undesirable characteristic was the proliferation of unique intelligence

organizations and systems. For example, a variety of secondary imagery systems were scattered throughout the theater. Some of the intelligence units used one kind of hardware to disseminate intelligence products, while others used something completely different. Some units were familiar with using computer-based data, while others still used hard copy reports. Thereby, it is no surprise that units had trouble coordinating and passing data efficiently.[60] During the war, the flow of intelligence largely followed the traditional "push" system. That is to say that tactical units primarily received intelligence products when the component headquarters pushed information downstream that it believed the units needed.

As a result of the enormous demand for BDA and media-releasable information, lower level commanders received virtually no current imagery for mission planning. For instance, the only imagery the Navy Carrier Baffle Groups (CVBGs) received was in the form of messages or photographs collected from other CVBGs in the area. A major problem in dissemination was that, of the nine electronic systems in theater, only two of them were interoperable. "Even if they all were interoperable, most of the systems were not even capable of receiving quality imagery required for strike planning."[61] Most of the Navy's imagery was produced from existing archival information received from Defense Intelligence Agency (DIA) which was pre-DESERT SHIELD imagery no newer than August 1990, with some from even 1989.[62] Dissemination was frustrating to the warfighters, and it prompted one Air Force Captain trying to target Iraqi sites to comment to *Newsweek:*

> The intelligence sucked. They kept hoarding their [reconnaissance] photos and I kept asking, "What are you saving this for, the next war?"[63]

The Joint Force Air Component Commander and the Joint Air Operations Center

When airborne resources are assigned, the JFC usually designates a Joint Forces Air Component Commander (JFACC) with the responsibility to plan, coordinate, allocate, and execute the air portion of the campaign. To accomplish the functions and

responsibilities tasked by the JFC, the JFACC creates a JFACC organization normally headquartered in the JFACC's operations center. The operations center is the heart of the JFACC's activities and will often be designated the joint air operations center (JAOC).[64]

The JAOC is an organization that is established for the planning, directing, and executing joint air operations in support of the JFC's operation or campaign objectives.[65] The only functions directed by Joint Doctrine to be common with all JAOC are combat plans and combat operations (combat plans drafts tomorrow's war and combat operations executes today's war).[66] Intelligence plans and intelligence operations are support components of their respective combat functions. The JAOC is structured after the Air Force's air operations center (AOC). This is significant in that the AOC structure has not changed much since operations in Vietnam.

During the Vietnam conflict, the Tactical Air Control Center (TACC) became the "doctrinally approved air command element of conventional war."[67] The TACC was structured around the operations division of combat plans and combat operations. The duality of the TACC architecture, adopted during DESERT SHIELD/STORM, caused friction in execution and resulted in "the inability to strike targets of opportunity without incurring unknown, but possibly, heavy costs."[68] This friction was a result of the compression of timelines on the battlefield. As mentioned earlier (see chapter 3), targeting and decision cycles have been reduced to the point that the existing intelligence architecture cannot respond effectively to the increased flow and decreased timelines required for this type of warfare.

Following the Gulf War, studies of the airborne command and control structures and initiatives toward joint warfare led to the revision of operational doctrine and force structure. The TACC was formally renamed the AOC, but the organizational structure and mission remained the same as the original conceptual architecture developed in Vietnam.[69] Emerging technologies, such as the Contingency Tactical Air Control and Planning System (CTAPS), have been incorporated to resolve some of the command and

control problems. However, it does not address the fundamental organizational problem. In fact, the CTAPS software does not make allowances for airborne reconnaissance sensors other than photographic imagery. "The rapid paced, information intensive warfare faced requires the ability to evaluate airborne reconnaissance information and translate it into targeting objectives in real time."[70] The current structure of the JAOC does not support the evolving airborne reconnaissance systems in a manner that optimizes their capabilities.

Recommendations

No single collection platform meets all mission task requirements of the modern warfare environment. Collectively, airborne reconnaissance systems complement each other. However, if not properly understood, managed, and employed, the intelligence gained is insufficient to support the warfighter. As the DARO, Services and intelligence agencies work together to correct equipment deficiencies, it becomes critical that the Services work to correct flaws in planning, tasking, control, and dissemination. This requires corrective action in areas of organization, doctrine, and training.

Organization. Within a Unified command and a JFC organization, there needs to be a functioning JIC and JRC consisting of experienced military members with a thorough knowledge of reconnaissance systems' capabilities (i.e., platforms, sensors, datalinks, and ground stations). These staffs should be assigned to the J2 and J3 as outlined in Joint Doctrine (e.g. Joint Pub 3-55 and 3-56.1).

The TACC architecture of DESERT SHIELD/STORM did not effectively employ airborne reconnaissance operations in the joint environment. Current joint warfare doctrine has accepted the same format for the JAOC. An interim solution to the airborne reconnaissance paradigm is the establishment of a joint reconnaissance cell within the JAOC. This reconnaissance cell would provide direct coordination with the JFC staff to maximize the effectiveness of the airborne reconnaissance strategy and

coordinate actions of airborne reconnaissance and surveillance, and command and control platforms enabling the JFACC to preserve forces, achieve economies, and accomplish operational objectives. The joint reconnaissance cell would be composed of operations and intelligence personnel with expertise in airborne reconnaissance procedures and collection management. It would be the central manager for all airborne reconnaissance operations and be responsible for validating requirements, building tracks, scheduling missions, monitoring launch and recovery, and reporting for all reconnaissance sorties. This concept would give the JFACC a direct point of contact for information on reconnaissance which does not presently exist in the JAOC and provide for mutual support between joint reconnaissance assets, attaining optimum effectiveness.[71] Independent of combat operations and combat plans, the joint reconnaissance cell would achieve the flexibility required by modern systems while maintaining integration with the air campaign conducted by the JAOC.

Many believe this is only a temporary fix and that a complete revision of the AOC's doctrine and organization must occur, which relates to a revision of the JAOC.[72] This restructure would require planners to integrate all elements of air warfare, including airborne reconnaissance, to obtain an architecture which will support an ever evolving joint environment.

Doctrine. The changes to doctrine were addressed in the previous paragraphs with changes to organization. However, one basic rule must be adhered to--commanders at all levels must follow the guidance/doctrine set forth in joint publications. Although not directive in nature, these publications normally have the best solutions to any situation and should be followed or changed to reflect the best doctrine. When a commander deviates from doctrine because he/she believes the situation warrants it, he/she must ensure that decision is not counter productive to the mission. General Omar Bradley said it best:

> Our military forces are one team--in the game to win regardless of who carries the ball. This is no time for "Fancy Dans" who won't hit the line with all they have on every play, unless they can call the signals. Each player on this team--whether he shines in the spotlight of the backfield or eats dirt in the line--must be an all-American.[73]

Training. Technology, equipment, and doctrine are all-important and necessary aspects of any military organization, but there are others that are at least equally significant: experience and confidence.[74] These enviable characteristics can only be obtained from performing a task with repetition. "Training as you fight" instruction is emphasized at the Air Force's Red Flag and Fighter Weapons School, the Navy's Top Gun and "Strike University," the Marine Corps' "postgraduate" air warfare training program at Yuma Marine Corps Air Station, and the Army's National Training Center (NTC). Realistic training is required at all levels of service. However, a lack of funds and of the availability of airborne reconnaissance platforms to participate in exercises makes it nearly impossible to accomplish this. Although these assets are limited, the military cannot afford to simply ignore this shortfall. Every effort must be made to include intelligence staffs, platforms, and operators in training exercises and not just "script" the reconnaissance assets and intelligence cycle as is presently done in many exercises.

As mentioned earlier in this chapter, airborne reconnaissance is dependent on the intelligence cycle. This cycle did not work very efficiently during DESERT SHIELD/STORM because it was not completely understood. Training, especially joint training is required to exercise the system, "work the bugs out," observe the capabilities and limitations of each reconnaissance system, detect shortfalls in organizational staffs and command and control procedures. The administrative side of planning should be exercised as much if not more than the actual execution.

CHAPTER 6

CONCLUSION

"Would you tell me, which way I ought to walk from here?"
"That depends a good deal on where you want to get to," said the Cat.
"I don't much care where," said Alice.
"Then it doesn't mater which way you walk," said the Cat.

Lewis Carroll
Alice in Wonderland

It seems apparent which way the Department of Defense should proceed to ensure adequate intelligence for the National Command Authorities and the warfighter at all levels. However, it appears that progress is not being made. For example, on September 11, 1995, the Department of Defense Scientific Advisory Board (SAB) visited the Adriatic AOR and discovered the problems plaguing the warfighter, with respect to airborne reconnaissance, included insufficient communication, lack of broad area coverage, and the ability to obtain timely, quality imagery. Additionally, senior U.S. military officials complain that trying to gather combat intelligence in Bosnia is producing the same problems in gathering and disseminating data encountered during DESERT STORM.[75] It has been over four years since the Persian Gulf War and in-depth studies by civilian and military agencies have analyzed every discrepancy, Congress has received testimony on shortfalls and corrective actions, and new agencies were created (e.g., DARO and the Central Imagery Office) to solve the problems. Then why are the same problems still present with airborne reconnaissance and the intelligence community?

The answer seems to be the same at every turn--progress has been stymied by a combination of funding constraints and technical challenges. The national security strategy and national military strategy both state that enhancements to intelligence remains a top priority. However, the intelligence budget has declined for seven straight years.[76] It becomes easy to rest on one’s accomplishments in the Persian Gulf and

believe if we had to, we could do it again. However, if the intelligence community continues on its present course, it risks having a hollow, poorly trained and equipped airborne reconnaissance force unable to contend with future threats. The failure of the intelligence system and the resulting shootdown of an Air Force F-16 by Bosnian Serbs proves that we are not always ready or capable.

Successful military operations depend on the knowledge of enemy force capabilities, dispositions, intentions, and operations as well as the battlefield environment. The methods and capabilities for providing intelligence to users must significantly improve. Only by changing the four pillars of reconnaissance (equipment, doctrine, organization, and training) can the legacy of unresponsive, inadequate, and redundant airborne reconnaissance systems be broken.

Change to airborne reconnaissance equipment (i.e., platforms, sensors, datalinks, and ground stations) has been an on going process with no overall focused guidance. The catalyst for this change is the DARO and its vision of *extended reconnaissance* and the *Objective Architecture.* A balance and trust must be developed between the DARO and the Services where the DARO maintains oversight guidance of future upgrades and acquisition of airborne reconnaissance equipment, with the Services providing a "check and balance" of those decisions with respect to acquisition and maintaining operational control over the assets. In addition, the DARO must remain sensitive to Service requirements when making system/budgetary "trade-offs," while the Services must be aware and cautious of parochialism and ensure the needs of the warfighters are being met.

The challenges caused by decreasing resources, a constrained budget environment, aging airborne reconnaissance platforms, and the increasing sophistication and technical capabilities in the hands of future adversaries all mandate innovation, by all agencies, to accomplish the DARO's goal *of extended reconnaissance.* This innovation must be based upon a shared vision of support to national, theater, and

tactical reconnaissance and intelligence consumers. Shortfalls and discrepancies can be solved with proper future investment, adhering to interoperability/commonality standards, and joint effort by Services, intelligence agencies, and the DARO.

Changes in doctrine must establish the framework for airborne reconnaissance forces to operate as an integral part of a joint team. Fundamental concepts and principles contained in doctrine should provide a common perspective from which to plan and execute airborne reconnaissance assets in joint and multi-national operations. The guidance presented in doctrine must be followed, except when in the judgment of the commander, circumstances dictate otherwise. The reconnaissance community should be committed to regularly revise and refine doctrine to ensure consistency and applicability to the warfighters needs.

To operate effectively in a joint operation, reconnaissance staffs must be well organized and consist of experienced military members with a thorough knowledge of airborne reconnaissance systems' capabilities. Each Unified Command and JTF organization must have a functioning JIC and JRC assigned to the J2 and J3 as outlined in joint doctrine. Additionally, a joint reconnaissance planning cell should be created within the JAOC to provide direct coordination with the JFC's staff to maximize the effectiveness of airborne reconnaissance strategies and assets. Comprised of operations and intelligence personnel, this planning cell would give the JFACC a direct point of contact for information on reconnaissance which does not presently exist in the JAOC and provide for mutual support between joint reconnaissance assets.

Training links changes in equipment, doctrine, and organization by evaluating each in realistic as possible conditions exposing flaws, shortfalls, and deficiencies, while highlighting what works. Furthermore, an important by-product of training is the attainment of experience and confidence, which enhances efficiency and productivity. For these reasons, realistic training is a must at all levels of service. However, a lack of funds and the availability of airborne reconnaissance platforms to participate in exercises

makes it nearly impossible to accomplish. Every effort must be made to include intelligence staffs, platforms, and operators in training exercises and not just simulate the reconnaissance asset and the intelligence cycle as is presently done today.

The problems and shortfalls with airborne reconnaissance were highlighted by the Gulf War, the agencies have been created to correct the deficiencies, and now its just a matter of agreeing on the correct path.

Notes

[1] Griffith, Samuel. (1971) *Sun Tzu, The Art of War.* New York: Oxford University Press, p 144-149.

[2] McDonald, Robert. (1993) A Selected Bibliography on Imagery Reconnaissance and Related Matters. Defense Intelligence College. Department of Defense. Washington D.C., p ix.

[3] Hitchcock, Walter. ed. (1991) *The Intelligence Revolution, A Historical Perspective.* U.S. Air Force Academy, Office of Air Force History. Washington D.C.: Government Printing Office, p 276.

[4] Donald, David. (1987) *Spyplane.* London: Aerospace Publishing Limited, p 15.

[5] Hitchcock, p *235.*

[6] Futrell, Robert F. (1961). *The United States Air Force in Korea, 1950-1953* New York: Duell, Sloan and Pearce, p xvii citing FEAF Report on the Korean War, March 26, 1954, I, 130.

[7] Harvey, Charles, Maj, USAF. "Imagery Architecture 2000: The Eyes of Global Power." Research Fellow. Air University, Maxwell Air Force Base, Alabama. Research Report No, AU-ARI-93-4, p 4.

[8] Ibid, p 2.

[9] Korb, Lawrence. "Growth and Decline of Accounts through the Defense Investment Cycle." Paper prepared for the Fels Center of Government: University of Pennsylvania, 1992, p 10-11.

[10] Discussion with HQ USAF, Director of Forces, Combat Integration Division, Airborne Reconnaissance Branch (XOFI), the Pentagon. LTC Samuel Torrey and LTC Richard Arvin. 20 October 1995.

[11] Murray, Williamson. ed (1995) *Brassey's Mershon American Defense Annual.* Washington: Brassey's, Ohio State University: Mershon Center, p 85-86.

[12] Harvey, p 3.

[13] Ibid,p3.

[14] The issue of the MOHAWK vs. the U-2 is currently being debated within the Joint Staff by the Army and Air Force respectively. As Chief of U-2 Operations at the Pentagon, I was personally involved and worked with (and on certain occasions against) army personnel in considering alternatives for fulfilling this requirement.

[15] Hitchcock,p 233.

[16] Armistead, Gary, Col, USAF, Directorate of Requirements, Space and Reconnaissance Division. Personal Interview. 30 October 1995.

[17] Scott, William. "High Demand Stretches NRO Intelligence Assets." *Aviation Week & Space Technology.* February 1, 1993, p 49-52.

[18] Shultz, Richard and Pfaltzgraff, Robert. (1992) *The Future of Air Power in the Aftermath of the Gulf War,* Maxwell Air Force Base, Alabama: Air University Press, p 19.

[19] The Office of the Secretary of Defense. *The Integrated Airborne Reconnaissance Architecture.* The Defense Airborne Reconnaissance Office, Washington D.C.: 1992, p iii.

[20] The Joint Staff. "Joint Unified Lessons Learned (KILL) Database." The Pentagon, Washington, D.C. Thanks to MSGT Nolls, USAF and his staff for assisting me in accessing this database.

[21] *The Integrated Airborne Reconnaissance Architecture,* p 2-4.

[22] Hallion, Richard. (1992) *Storm over Iraq, Air Power and the Gulf War.* Washington & London: Smithsonian Institution Press, p 204-205.

[23] Ibid, p 205-206.

[24] *The Integrated Airborne Reconnaissance Architecture,* p *2-5.*

[25] Israel, Kenneth, MGen, USAF, Director of the Defense Airborne Reconnaissance Office. Personal Interview. 1 November 1995.

[26] *The Integrated Airborne Reconnaissance Architecture,* p 2-6.

[27] The Office of the Secretary of Defense. *The Manned Airborne Program Plan.* The Defense Airborne Reconnaissance Office, Washington D.C.:12 August 1994, Appendix A

[28] Israel, Kenneth, MGen, USAF, Director of the Defense Airborne Reconnaissance Office. Personal Interview, 1 November 1995.

[29] *The Integrated Airborne Reconnaissance Architecture,* p iii, Executive Summary.

[30] Clapper, James MGen, USAF. "Desert War was Crucible for Intelligence Systems." *Signal.* September 1991, p 77-80.

[31] *The Integrated Airborne Reconnaissance Architecture,* p 2-6. Numbers verified with Maj Mark Cole, HQ USAF, Director of Forces, Combat Integration Division, Airborne Reconnaissance Branch (XOFI), the Pentagon on 18 October 1995.

[32] *The Manned Airborne Program Plan,* Appendix A.

[33] *The Integrated Airborne Reconnaissance Architecture,* p 2-7.

[34] Deputy Secretary of Defense Memorandum to the Secretaries of the Military Departments, et al., Establishment of the Defense Airborne Reconnaissance Office (DARO), dated 6 November 1993.

[35] Program Decision Memorandum, dated November 10, 1993. Program Budget Decision Number 710, Defense Airborne Reconnaissance Office (DARO), dated December 18, 1993. Department of Defense Directive Number 5134.

[36] DARO Aims to Get Most out of U.S. Reconnaissance Assets." *Jane's Defense Weekly,* October 22, 1994,p 19.

[37] *The Integrated Airborne Reconnaissance Architecture,* p i, Executive Summary.

[38] Israel, Kenneth, MGen, USAF, Director of the Defense Airborne Reconnaissance Office. Personal Interview. 1 November 1995.

[39] Discussion with HQ USAF, Director of Forces, Combat Integration Division, Airborne Reconnaissance Branch (XOFI), the Pentagon. LTC Samuel Torrey and LTC Richard Arvin. 20 October 1995.

[40] "DARO Aims to Get Most out of U.S. Reconnaissance Assets," p 19.

[41] Israel, Kenneth, MGen, USAF, Director of the Defense Airborne Reconnaissance Office. Personal Interview. 1 November 1995.

[42] Murray, p 117-120.

[43] The Joint Staff. *Joint Publication 3-0, Doctrine for Joint Operations.* Washington D.C.: 1 February 1995, p 11-13.

[44] ALSA Pamphlet "REECE-J", Multi-Service Procedures for Requesting Reconnaissance Information in Joint Operations. Langley AFB, VA: Headquarters Air Combat Command/XPJO, July 1993, p 3-1.

[45] United States Department of Defense. *Conduct of the Persian Gulf War--Final Report to Congress.* Washington D.C.: April 1992, p C-7.

[46] Roll, Craig, LCDR, USN. "The Operational Employment of Joint Combat Aerial Reconnaissance Assets." Unpublished Research Paper. Naval War College. Newport, Rhode Island. March 10, 1993, p 12.

[47] *Joint Publication 2-0,* p 11-3.

[48] *Intelligence Successes and Failures in Operations DESERT SHIELD/STORM.* Report of the Oversight and Investigations Subcommittee on Armed Services, House of Representatives, One Hundred Third Congress, First Session, August 16, 1993, p 19.

[49] The Joint Staff *Joint Publication 2-0, Joint Doctrine for Intelligence Support to Operations.* Washington D.C.: 12 October 1993, p 11-3.

[50] The Joint Staff *Joint Publication 3-55, Doctrine for Reconnaissance, Surveillance, and Target Acquisition Support for Joint Operations (RSTA).* Washington D.C.: 14 April 1993, p III-2.

[51] *Conduct of the Persian Gulf War--Final Report to Congress,* p C-l1.

[52] ALSA Pamphlet "REECE-J," p 3-1.

[53] Roll, p 17.

[54] Ibid, p 17.

[55] Jackson, Richard, Maj, USAF. "The JTF--Analysis of Airborne Reconnaissance Operations." Unpublished Research Paper. Naval War College. Newport, Rhode Island. Fall 1995, p 8.

[56] *Joint Publication 2-0,* p II-8.

[57] *Conduct of the Persian Gulf War--Final Report to Congress,* p C- 14.

[58] Roll, p 14.

[59] *Intelligence Successes and Failures in Operations DESERT SHIELD/STORM,* p 13.

[60] Clapper, p 77-80.

[61] Roll, p 15.

[62] Ibid, p 14.

[63] Waller, Douglas and Barry, John. "The Day We Stopped the War." *Newsweek.* January 20, 1992, p 16-25.

[64] The Joint Staff *Joint Publication 3-56.1, Command and Control for Joint Air Operations.* Washington D.C.:14 November 1994, p 11-6.

[65] Ibid, p GL-6.

[66] Ibid, p 11-7.

[67] Sink, Taylor. Rethinking the Air Operations Center--Air Force Command and Control in Conventional War. Thesis, School of Advanced Airpower Studies, Maxwell AFB, Alabama. September 1994, p 20.

[68] Ibid,p25.

[69] Ibid, p 32.

[70] Jackson, p 9.

[71] This recommendation was a collaboration, derived from discussion between Maj Richard "Scoop" Jackson while he was assigned to USAFE, Maj Paul "Admiral" Nelson, HQ USAF/XORR, and myself while I was a member of HQ USAF/XOFI at the Pentagon. Maj Jackson and Maj Nelson should get most of the credit as these were their brilliant ideas and I just argued certain points.

[72] Sink, p 48.

[73] General Omar Bradley, USA. Statement to the House Armed Services Committee, 19 October 1949. Excerpt from *Joint Publication 3-0, Doctrine for Joint Operations.* Washington D.C.: 1 February 1995, p 1-7.

[74] Hallion, p 83.

[75] Israel, Kenneth, MGen, USAF, Director of the Defense Airborne Reconnaissance Office. Personal Interview. 1 November 1995.

[76] United States Congressional Record- the House of Representatives. Washington, D.C.: Government Printing Office, 13 September 1995, Page 8817.

Acronyms

ACTDs	Advanced Concept Technology Demonstrations
ANG	Air National Guard
AOC	Air Operations Center
AOR	Area of Responsibility
ARL	Airborne Reconnaissance Low
ASARS	Advanced Synthetic Aperture Radar System
ATACMS	Advanced Tactical Missile System
ATARS	Advanced Tactical Airborne Reconnaissance System
ATO	Air Tasking Order
AWACS	Airborne Warning and Control System
BDA	Battle Damage Assessment
CIA	Central Intelligence Agency
CARS	Contingency Airborne Reconnaissance System
CENTCOM	Central Command
CIGSS	Common Imagery Ground/Surface System
CINCCENT	Commander and Chief, Central Command
COTS	Commercial Off-the-Shelf
CTAPS	Contingency Tactical Air Control and Planning Center
CVBG	Carrier Battle Group
DARO	Defense Airborne Reconnaissance Office
DUSD(AT)	Deputy Under Secretary of Defense for Advanced Technology
EGSM	Enhanced Ground Station Module
FY	Fiscal Year
GDIP	Government Defense Intelligence Program

GSM	Ground Station Module
IMINT	Imagery Intelligence
IRIS	Intelligence Reconnaissance Imaging System
JAOC	Joint Air Operations Center
JCS/OSD	Joint Chiefs of Staff Office of the Secretary of Defense
JFACC	Joint Forces Air Component Commander
JFC	Joint Force Commander
JIC	Joint Intelligence Center
JPO	Joint Program Office
JRC	Joint Reconnaissance Center
JSTARS	Joint Surveillance Target Attack and Radar System
JTF	Joint Task Force
J2	Joint Force Intelligence Officer
J3	Joint Force Operations Officer
MASINT	Measurement and Signals Intelligence
MIPE	Mobile Imagery Processing Element
NFIP	National Foreign Intelligence Program
NRO	National Reconnaissance Office
NTC	National Training Center
OBC	Optical Bar Camera
PARPRO	Peacetime Airborne Reconnaissance Procedures and Reconnaissance Operations

PIF	Photo Interpretation Facility
RADINT	Radar Intelligence
SAB	Scientific Advisory Board
SAR	Synthetic Aperture Radar
SCDL	Self Contained Datalink
SIGINT	Signals Intelligence
SRO	Sensitive Reconnaissance Operations
SYERS	SENIOR YEAR Electro-Optical Reconnaissance System
TACC	Tactical Air Control Center
TARP S	Tactical Airborne Reconnaissance Pod System
TRS	Tactical Reconnaissance Squadron
UAV	Unmanned Airborne Vehicle

BIBLIOGRAPHY

Books

Donald, David. (1987) *Spyplane.* London: Aerospace Publishing Limited.

Futrell, Robert F. (1961). *The United States Air Force in Korea, 1950-1953.* New York: Duell, Sloan and Pearce, p xvii citing FEAF Report on the Korean War, March 26, 1954.

Griffith, Samuel. (1971) *Sun Tzu, The Art of War.* New York: Oxford University Press.

Hallion, Richard. (1992) *Storm over Iraq, Air Power and the Gulf War.* Washington & London: Smithsonian Institution Press.

Hitchcock, Walter. ed. (1991) *The Intelligence Revolution, A Historical Perspective.* U.S. Air Force Academy, Office of Air Force History. Washington D.C.: Government Printing Office.

McDonald, Robert. (1993) A Selected Bibliography on Imagery Reconnaissance and Related Matters. Defense Intelligence College. Department of Defense, Washington D.C.

Murray, Williamson. ed (1995) *Brassey's Mershon American Defense Annual.* Washington: Brassey's, Ohio State University: Mershon Center.

Shultz, Richard and Pfaltzgraff, Robert. (1992) *The Future of Air Power in the Aftermath of the Gulf War.* Maxwell Air Force Base, Alabama: Air University Press.

Periodicals

Clapper, James MGen, USAF. "Desert War was Crucible for Intelligence Systems." *Signal.* September 1991: 77-80.

"DARO Alms to Get Most out of U.S. Reconnaissance Assets." *Jane's Defense Weekly,* October22, 1994: 19.

Fulghum, David. "USAF Pursues Stealthy UAV to Improve Reconnaissance." *Aviation Week & Space Technology.* January 17, 1994: 44.

Morrocco, John, "Airlift, Intelligence Continue to Pose Problems." *Aviation Week & Space Technology.* January 17, 1994: 42-46.

Scott, William. "High Demand Stretches NRO Intelligence Assets." *Aviation Week & Space Technology.* February 1, 1993. 49-52.

Steele, Robert. "A Critical Evaluation of U.S. Intelligence Capabilities." *International Journal of Intelligence and Counterintelligence.* Volume 6, No. 2, Summer 1993:173-193.

Waller, Douglas and Barry, John. "The Day We Stopped the War." *Newsweek.* January 20, 1992: 16-25.

Governmental Publications

ALSA Pamphlet "REECE-J", Multi-Service Procedures for Requesting Reconnaissance Information in Joint Operations. Langley AFB, VA: Headquarters Air Combat Command/XPJO, July 1993.

The President of the United States. *A National Security Strategy of Engagement and Enlargement.* Government Printing Office, The White House, February 1995

Department of the Air Force. *AFM 1-1, Basic Aerospace Doctrine of the USAF*, HQ U.S. Air Force, Washington D.C.: Government Printing Office.

Department of the Navy. *FMFM-1, Warfighting,* HQ U.S. Marine Corps, Washington D.C.: Government Printing Office.

Department of the Army. *FM 100-5, Operations,* HQ U.S. Army, Washington D.C.: Government Printing Office.

The Joint Staff *Joint Publication 1-02, Department of Defense Dictionary of Military and Associated Terms,* 1 December 1989.

The Joint Staff *Joint Publication 2-0, Joint Doctrine for Intelligence Support to Operations.* Washington D.C.: 12 October 1993.

The Joint Staff. *Joint Publication 3-0, Doctrine for Joint Operations.* Washington D.C.: 1 February 1995.

The Joint Staff *Joint Publication 3-55, Doctrine for Reconnaissance, Surveillance, and Target Acquisition Support for Joint Operations (RSTA).* Washington D.C.: 14 April 1993.

The Joint Staff *Joint Publication 3-56.1, Command and Control for Joint Air Operations.* Washington D.C.: 14 November 1994.

Intelligence Successes and Failures in Operations DESERT SHIELD/STORM. Report of the Oversight and Investigations Subcommittee on Armed Services, House of

Representatives, One Hundred Third Congress, First Session, August 16, 1993.

The Office of the Secretary of Defense. *The Integrated Airborne Reconnaissance Architecture.* The Defense Airborne Reconnaissance Office, Washington D.C.: 1992.

The Office of the Secretary of Defense. *The Manned Airborne Program Plan.* The Defense Airborne Reconnaissance Office, Washington D.C.: 12 August 1994.

United States Department of Defense. *Conduct of the Persian Gulf War--Final Report to Congress.* Washington D.C.: April 1992.

United States Congressional Record- the House of Representatives. Washington, D.C.: Government Printing Office, 13 September 1995.

Papers

Harvey, Charles, Maj, USAF. "Imagery Architecture 2000: The Eyes of Global Power." Research Fellow. Air University, Maxwell Air Force Base, Alabama. Research Report No. AU-ARI-93 -4.

Jackson, Richard, Maj, USAF. "The JTF--Analysis of Airborne Reconnaissance Operations." Unpublished Research Paper. Naval War College. Newport, Rhode Island. Fall 1995.

Korb, Lawrence. "Growth and Decline of Accounts through the Defense Investment Cycle." Paper prepared for the Fels Center of Government: University of Pennsylvania.

Paylor, Mark, LCDR, USN. "Operation Vigilant Warrior, Joint Interoperability--Lessons Learned." Unpublished Research Paper. Naval War College. Newport, Rhode Island. Spring 1995.

Roll, Craig, LCDR, USN. "The Operational Employment of Joint Combat Aerial Reconnaissance Assets." Unpublished Research Paper. Naval War College. Newport, Rhode Island. March 10, 1993.

Sink, Taylor. Rethinking the Air Operations Center--Air Force Command and Control in Conventional War. Thesis, School of Advanced Airpower Studies, Maxwell AFB, Alabama. September 1994.

Interviews

Armistead, Gary, Col, USAF, Directorate of Requirements, Space and Reconnaissance Division. Personal Interview. 30 October 1995.

Israel, Kenneth, MGen, USAF, Director of the Defense Airborne Reconnaissance Office. Personal Interview. 1 November 1995.

Discussion with HQ USAF, Director of Forces, Combat Integration Division, Airborne Reconnaissance Branch (XOFI), the Pentagon. LTC Samuel Torrey and LTC Richard Arvin. 20 October 1995.

Other

Deputy Secretary of Defense Memorandum to the Secretaries of the Military Departments, et al., Establishment of the Defense Airborne Reconnaissance Office (DARO), dated 6 November 1993.

Program Decision Memorandum, dated November 10, 1993. Program Budget Decision Number 710, Defense Airborne Reconnaissance Office (DARO), dated December 18, 1993. Department of Defense Directive Number 5134.

The Joint Staff. "Joint Unified Lessons Learned (JULL) Database." The Pentagon, Washington, D.C. Thanks to MSGT Nolls, USAF and his staff for assisting me in accessing this database.